Menlo Park Notebook #52 [N-79-07-31]

This notebook covers the period July 1879-January 1880. Most of the entries are by Charles Batchelor. There are also entries by Edison and A. Poinier. The name of James Seymour appears occasionally as a witness. The first part of the book contains notes and drawings of experiments on metal filaments. Many relate to insulating materials used for coating the filaments. The second part of the book contains notes and drawings relating to the important series of experiments conducted in October 1879, which led to the invention of the carbon filament lamp. There are also notes and drawings documenting the development of the carbon filament through the end of 1879. A special cover placed over the book contains a label indicating that this notebook was used as an exhibit in the case of Edison Electric Light Co. v. U.S. Electric Lighting Co., in which Edison's patent on the carbon filament was sustained (see Litigation Series). The book contains 280 numbered pages. Some pages have been torn out of the book.

Blank pages not filmed: 54-55, 108-109.

Missing page numbers: 217-218.

Com E. P. Co
vs
McCleerhart Co
Degs Exhibit
Batchelor Note book
1052 March 7, 1889
W.D.D.
E.C.

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

GENERAL [illegible]

[illegible], 189[illegible].

July 31st 1879

~~Prof~~ Degs Exhibit Chas. Batchelor

Acetates.

Acetate of Calcium is decomposed by heat into Acetone and Carbonate Calcium

All ~~carbonate~~ acetate which decompose easily and from stable carbonate is same thing, —

If so, then our coating is a Carbonate of Magnesia & the carbonate has to go off under high heat as

Carbonate Calcium strong red heat
" Barium white heat
" Magnesium intense heat

the decomposition of Carb. Calcium commences at a low red heat so that the ~~[illegible]~~ heating a wire of this covering it should be left at low red for a long time

Typo insulation

Nitrates.

Nitrate Calcium is decomposed at a comparatively low temperature.

Nitrate of Lanthanum at red heat is completely decomposed leaving light brown oxide

July 31 1879. 3

acetate zinc - T. A. Chas Batchelor

will not coat a wire after 30 dippings - but the surface of Pt is slightly roughened as if zinc reduced and combined. perhaps the Pumpblack of Candle reduced it, there is a slight change in the metallic color but not the slightest trace of an oxide ——

Acetate Cerium -

No oxide - attacks platinum, like zinc, but thus are iridescent colors ——

Acetate Calcium

coats easily at low heat but is very easily rubbed off and when bent it peels off in shreds

Nitrate of Calcium TAG

will not coat at all and after 20 dippings does not seem to affect the wire

Nitrate of Cadmium

Difficult to get anything on at all and after you get the brown oxide on a red heat takes it all off again —

Nitrate Magnesium

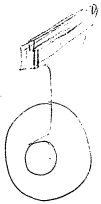
Considerable trouble to get it on even, though a coating can be got on affects platina as much as the Acetate

Aug 1st 1899 9

Chas. Fletcher.

Zirconium Acetate of Fe.

Coats very well indeed I think a little better than Magnesium It does not affect the wire and will bend very short. It is very hard to get off. Wound a piece of iron wire which was coated with Zirconia, and made all the spirals touch and then put 9 cells C+H battery through it, It gave good light (white) and on examining under the microscope after it seemed to have lost nothing but the covering was slightly browned the acetate must be evaporated down to a syrupy solution



Electric light Aug 10th 1879 /31

Coating Wires for Lamps. Charles Tchelvi

I took 32 in of ·004 25% Platinum Iridium wire and brought it up in vacuum exciting 20 minutes, then coated it with ·001 Zirconia. After commencing to coat, the wire broke in my hands and the two ends of wire showed structure like this as if one half of section was crystals of a blackish grey color.

See page 16

T A E

Electric light
instrument for bringing
the wire in
Vacuo

Aug 10
1879

Chas. S. Batchelor

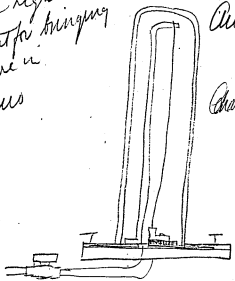


Fig 2

~~the~~ This happen'd a number of time and Edison thinks it not so much due to the wire having flaws, as to some change produced in the wire during the process I put it through. We now began to investigate it & found that .004 20/ platinum Iridium would stand a breaking strain of 2½ lb, and every time it broke, it would either show a well drawn out (center punch) point or a chisel point showing that the wire stretched down till it finally broke. ~~These~~ so:—

These breaks were not at all like the breaks made when they broke in my hands without pressure which showed a crystalline structure, and broke off sharp —

If we brought up a spiral of one layer on a lens cylinder it gave a splendid light, and would never cross in the spiral; but when heated too much, the leading wires would go first; but if we made the spiral of two layers, there seemed to be something that crossed the bottom and top in between layers

it had got very hot, always
cutting out half the spool ab-
most immediately, and gradually
cutting out till there was nothing
left but the few bottom turns
in circuit. Whatever it is that
crosses, seems to move around
between the layers as if it was
a liquid conductor. It seems as
if the Lucomia itself at such
a heat was a conductor, which
shows itself plainer on the 2 layers,
because, there are points between
the bottom and top layer of con-
siderable tension inversely at bottom
See Page 25

Electric Light. Aug 10 1849 33

Heating wires

Try baking on the coats at about 200 Fah. and when on thick enough bring up very slow indeed

Take 10 short pieces and coat thin and put in oven —

T A S

It may be however that it is due to impurities such as silica in the Zirconia and also from the lime

We tried to coat the core with light coating of Zirconia Acet and then put on coat of acetate Magnesia after bringing up the special and looking at under the Micro. we found that the Magnesia was almost all gone but the Zirconia was on in a dense vitreous mass. —

T.E.

The best way I find to coat the core is to evaporate the

acetate of Zirconia down the it
shows a slight milkiness with
some white sediment and then
I rub between your fingers slightly
till it feels slightly sticky and
apply to the wire by rubbing be-
tween your fingers till they
become almost dry then pass
the wire through the candle flame
not in the hottest part but
~~[illegible]~~ just above the
wick so that it never gets
above a low red. I am
always careful that the

were it never as wet till the heat of candle makes it spread in the least ——————

We find that equal mixtures of Acetate of Zirconia and Acetate of Magnesia make a good coating which looks very fine after being under the action of great heat

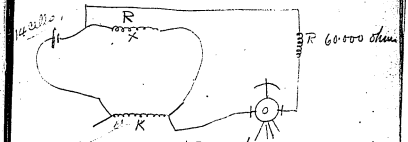
Aug 15th 1849
Chas Batchelder
Jr E

August 11 1879 T.A.E.
Chas Batchelor

Tried strong acetate Titanium Pure, Could not get the slightest trace to adhere to the wire. it was somewhat syrupy. I found that some crystals formed by evaporating it to a syrup got on fingers and scratched the platina wire,

Tried - Nitrate Strontia : syrupy - got Strontium color in candle, could only get it to adhere in drops. This looks as if there were impurities in the salt although its one of Kelly's pure

Wire Coating



2 wires Coater + tweater together

~~1 Cell Battery~~

~~Battery No of X Effect~~

~~1 Cell 700 0~~

~~1 " 50 Leakage~~

~~1 " 40 60 Leakage~~

Aug 12 1797.

Yttrium Ox,
Glucinic Ox,
Aluminium Ox
Zirconium Ox,
Silica
Thorium Ox,
Chromic Ox
Tungsten Hydrate

} all form gelatinous oxides and therefore will fuse down into vitreous mass

---

Edison tried Tannin Acetate. it only coats the wire thin exceedingly expensive on the fingers whilst putting it on, and globulate on the wire, forming beautiful amethyst globules

Aug 12 1899 37

on the wire which run up hill — It does not attack the wire

ASE

Chloride Zirconia

This is very difficult to get on the wire and only goes on very rough. I thought at first it affected the wire considerably but find that it only slightly attacks it

Chas Watson

Zirconia Hydrate -

Coated a wire with the which is fine gelatinous Zirconia in water — Could only get on very thin coating but Spiral made of it stood very intense heat without flossing

Aug 12.

We find that the battery put on two covered wires as:

covered with Acetate Lithia did not connect, but if a spirit lamp was applied so as to heat them up, they would make circuit as soon as it got a little above a red. The point where it would make connection always showed as if some impurity in the covering had been present and attacked the platinum changing it in some way. The phaenomena does not show globules at these points as it generally does when it

Cutting Wires for Electric Lighting Aug 12 1879 T.A.E

melts or runs together, but seemed to show a crystalline fracture.

Edison wound a couple of wires together that had been covered with Alumina and these did not cross under the same conditions nor yet when heated by the blowpipe ———

Chas Batchelor

Electric Light Aug 13 1879
Covering Wires Chas Batchelor

I took 6 wires and covered them with Acetate Lysonia, and brought them up to white heat and then doubled them up and twisted them together and connected battery to two ends and then cut the end at X., on applying the heat of a spirit lamp to this when the battery of 14 cells was on the two ends

Fig

they all acted alike and crossed at a little above a red heat. Now as our wire is pretty pure and our Zirconia we have taken particular pains to have pure we must come to the conclusion that the Zirconia must be a conductor at that temperature

Electric Light Aug 24 1899
Cooling Wires
Tests
—Chas Batchelor

Plated a 32 c.p. wire with
Chloride of Aluminium .003
thick and wound in two layers
on spool. This coating when
on spool broke off a good
deal but for all that it was
brought up to a brilliant white
heat (though not to perfect in-
candescence) before it melted at
the bottom of spool. Under
the microscope it did not

H.A.R.

seem to have been caused by the tension, but seemed to have melted the first three turns on the bottom layer and broke the wire. Now the only difficulty to be overcome is the coating the wire so as to stick like the Zirconia and not crack when wound on small spool. This wire was platinum and was not brought up

Electric Light
Wire Coating for
Pipe Insulation

Aug 14 1879

Chas P Scotchler
T & E

Took some Quartz (Si) and powdered up fine and coated a wire by mixing it in water and putting on that way —
A spool of 2 layers came up very good showing perfect insulation and under the microscope showed clean melt with the coating melted down to perfectly clear glass-like coating —

Silica Coating

Electric light

Aug 14 1879 53

Under the Oxy. Hy. flame the following Tar
pressed cylinders acted as follows:—

Zucronia —

Electric light
Coating wires for
Lamp insulation

Aug 18th 1879 57

Chas Batchelor
T W E

In bringing up the small lime spools with 2 layers of .004 platina wire, we always find it hottest in the middle, owing to the conduction of heat away by the lime bobbin; I took one and made thin top and bottom coils

and now, when brought up the heat seems to be much better distributed; as the low red even little difference can be seen _____

Electric Light

Aug 19/79 59

Chas Batchelor

Ref. Insulation of wires

In coating with Corundum, if we could coat with very low heat (such as holding over a Kerosene lamp) it would save the trouble of first bringing up the wire and also prevent the cracking of the wire due to the heat of gas jet

I used for this purpose a little dextrine in the coating liquid, this is not ~~very~~ good although a light coating can be got on with patience. I tried various quantities of Dextrin but with no better effect

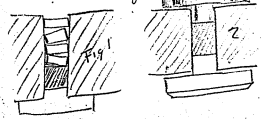
Tried same with Gum Tragacanth and Isinglass but although a coating can be got on it is immediately rubbed off by the hand.

Electric Light
Silica Spool for lamp. Aug 22nd 1899
Tag

Charles Batchelor.

1 Powdered Quartz (Si) and finely divided it by water so as to press it into a cylinder —
Find it difficult to make a hard solid cylinder of it dry as it powders on being rubbed by hand like sandstone
Tried a little Lecithin and Tragacanth with it — No good

Find that on our mould we cannot get the pressure we want on the material as the discs will not allow it. No fun that when six discs are in if they are not perfectly flat they must stand as in Fig. 1 and consequently



it requires as much power to press these down to place that it crushes some of the discs before it brings the material to a perfectly solid cylinder. Now we propose to press them down to $\frac{3}{4}$ long in this and then put them in another ~~press~~ die like 2 and press them till the two heads come down to bed on the die which will make it ½ inch: In this the enormous pressure comes direct on the material and is not transmitted through a number of steel bottom which have possibly untrue surfaces.

Sept 6th 1849

Lime powdered up fine spread in two minutes it ex ceedingly hard

T.A.P

Sept 8 1919

Spools for Electric Light & Ar

all pure chemicals

No 1 — 20 Alumina 80 Lime
2 — 20 Magnesia 80 Lime
3 — 50 Alumina 50 Magnesia
4 — 80 Alumina 20 Magnesia
5 — 50 Alumina 50 Strontia
6 — Pure Alumina pressed once
7 — Pure Silica
8 — Pure lime pressed once
9 — Pure Zirconia
10 — Cadmium Oxide
11 — Magnesia pressed once 1 pound
12

Chas Zatchetor

Sept 11th 1919 89

Lamp spools for Electric Light

·166
3·14
664
166
398·24
·4375
20066
2948668
1263712
168496
18428
·0248

·093
3·14
372
093
279
·29202
·085
146011
2336176
·12482170

18428 / ·0248 = 9·5
186
1060
1000
10
24

Small spool. (Helices) Sept 22nd 1899

·166 × 3·14 × ·4375 = ·1828

42124 × ·4375 = ·18428

Large such as we used in shop

·093 × 3·14 × ·085 = ·0248

difference

·18428 ÷ ·0248 = 7·5

Relative size of a small spool ~~which~~ as we bring up in a vacuum & the size we lighted up shop with.

We got from small one 8 candles therefore the large ones ought to give

8 × 7·5 = 60 candles

Chas Batchelor

Electric Light

Sept 24th 1879

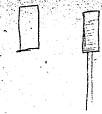
Lamp spool.

J. A. E.

Chas Batchelor

New method of winding spools: –

I wind one layer on the spool and fill up between the convolutions (which are slightly apart) with a thick solution of Acetate of Magnesia and Alumina put on by a brush; this is then baked at about 250° Fahr, and then another coating is put on & baked again; these are continued until the wire is entirely covered and about ¼ inch above the wire; another layer is then put on and this is set by a few brush-fulls of the solution —

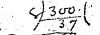


3

333

100
3
300

37
8
296



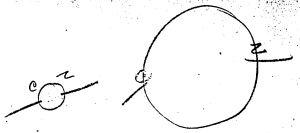
500
3
1500

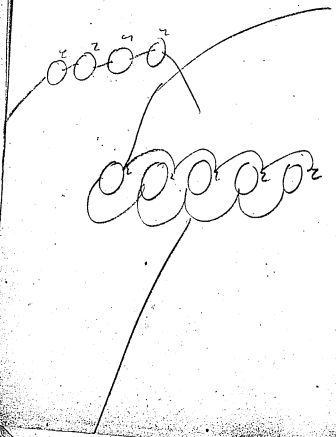
3/8

16 5

3 feet

Portland





Electric Light Sept 24th 1879

Lamps

Made ~~2~~ $\frac{3}{100}$ spinals of Lime tungstate

Made ~~2~~ — Zirconium Ox —

Made ~~2~~ — Titanic Ox —

Made ~~2~~ — Ammonium Ox —

Made ~~2~~ — Magnesia —

Made 2 — Glucina —

Made ~~2~~ — Yttric Ox —

Made ~~2~~ — Lime Ox —

2 — Silica

2 — Strontia

2 — [illegible] Ox

2 — [illegible] Ox

Made ~~2~~ — Molybdenum Ox

2 — Chromium Ox

2 of Barium Ox
2 of Lungwort Ox
~~2 of Sulphur Nigrum~~

Spent Covering Oct 6 1899 81

Cannot put the Sulphur On in any Form

Zinc oxide very difficult to get on in good covering — Can get very thin coating on but wipes off by hand — Made one spiral from Acetate of Zinc by reducing the Acetate to a syrup and then baking on —

Stannous Acetate will not coat the wire at all

Made a Zinc oxide by dipping spiral in solution of Zinc ox and water and burning ~~water out~~

Made a tin oxide by mixing oxide with water and dipping spiral coated very thick

Made 2 Titanium oxide spirals one by coating from solution in water & the other by dipping

Chas Batchelor

2/6

60
80
36 00

1/2 = 4 hr 060

111 - 36 time nine
144

1/8 x x = 1/12 533

38

12/330
27 2

·125
2.5
3.72
·3 0
2.72
2.73
7.19
10.72

6/32
5

·625
-18/5

1/6 ·333
1.5

·125 ·33 ·1875
·33
·561
·561
·1677

·1875
2.2
·2088

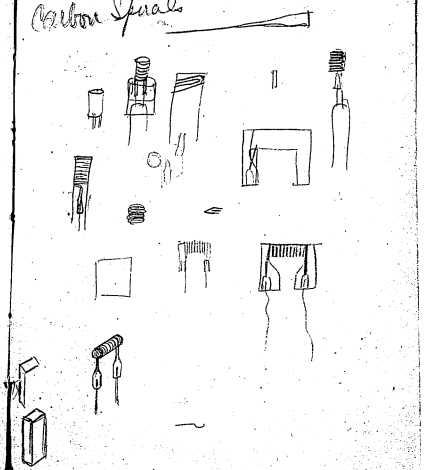
·653
·1306
·653
·326
·653
·1306
·653
·326
·1306
·1306
·1466

·208
·333
·2088
·2088
·6264
·6264

·1250

Electric light Oct 7 1879
Chas Batchelor

Carbon Spirals



Spiral of Carbon Oct 7 1899

Mould for Carbon Spiral Chas. Batchelor

Spiral must be ·18 long

Inside diameter ·1875 or 3/16

outside " ·207

Made a mould for squeezing put in some of Wallace soft carbon and squeezed it out of a hole ·02 diameter getting it out a yard long if required —

Could make more even sticks by rolling on glass plate with piece of very smooth wood.

these articles could be rolled down to '01 and then wound in spirals. We made some and baked them at a red heat for 15 minutes in a closed tube — When taken out they were hard and solid much more so than we expected and not at all altered in shape — A spiral made of 'burnt lampblack' mixed with a little tar was even better

than the Wallace mixture —
— With a spiral having 5 inches
of wire of ·01 we can get 100 ohms
— We now made a double spiral
on brass. So as to wind the
carbon so similar to ~~the~~ some of the
first platinum spirals we made —

Oct 21

circle proper (Carbon)
x broken out

Electric light Oct 21st 1879

Carbon Spirals

Made enclosed tube for the baking of the spiral to carbonize it. We found that the carbon always broke just as the junction of the carbon and platina so this we could not account for so I made a straight piece of carbon & fastened to a pair of wires and

put in a closed tube and heated the tube – I then found that at quite a low heat a yellow oil came from the carbon and ran down the tube and the carbon parted very easily just as if it had melted filling the tube with white smoke and having a yellow oily liquid on the top of centre glass which I suppose is Benzole or one of its first compounds

I now put another in a tube and baked it 1 hour at 165 F then ½ hour at 220 then 1 hour 320 when I took it out

it showed and oily liquid
(yellowish green) on glass
showing that the first product
had gone off and that is the one
that busted it before
I now heated the tube as hot
as I could in the flame and
I could not see any thing come
off except a slight white smoke
this we now blew in a bulb
& made a vacuum and with
9 cells C ~~the~~ Cell gave a deflec
43° showing as Upton tested

Electric Light Oct 21st 1879

Carbon wire

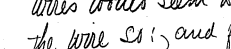
A spiral wound round a paper core no matter how thin always breaks, because it contracts so much, If the heating is done slowly this is modified but with the present proportion of tar and lampblack it will always break.

Clay put on a spiral to insulate the outside and prevent it from sticking together tends to crack the spiral still more

We now put a larger per centage of lampblack to same tar about twice as much and the

wire would still draw out at the ordinary temperature

The better way to carbonize these Carbon wires would seem to be to take the wire so; and fasten a platina end in it, and



then wound in form of a spiral so:

One of the great difficulties is to keep the spiral in position whilst you carbonize it; this might be remedied to a great extent by

using a hollow sleeve &
winding the spiral inside
with something to hold the
ends whilst they are being
fastened to the leading wire.

Electric Light

Oct 22nd 1879 105

9 am.

Carbon Spirals

No 9

Chas Batchelor

We made some very interesting experiments on straight ~~wires~~ carbons made from cotton thread &c.

we took a piece of 6 cord thread No 24 which is about 13 thousandths in thickness and after fastening to Pt wires we carbonized it in a closed chamber. we put in a bulb. and in vacuo it gave a light equal to about ½ candle 18 cells carbon. it had resistance of 113 ohms at starting & afterward went up to 140 — probably due to vibration

113
140

Carbon Lamps

Carbonizing process

We made lamps in same manner

1 — of — Vulcanized fibre

× 2 — Thread rubbed with tarred Lampblack

× 3 — Soft paper —

× 4 — Flax line

5 — Fine thread plaited together 6 strands —

6 — Soft paper saturated with tar

7 — 1 and Lamp-black with half its bulk of finely divided lime work down to 020 — straight one inch

× 8 — 20's 6 cord 8 strands —

× 9 — 20's Coats 6 cord ~~and~~ no coating of any kind

× 10 — Cardboard —

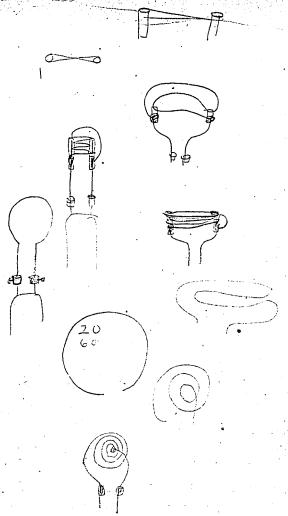
11 { Cotton soaked in tar (boiling) & put in

Electric Light Oct 21st 1879 111

No 2 lamp of page 107 had on 18 cells and gave an elegant light equal to about 22 candles.

No 9 ordinary thread Coats 6 cord #248 —
Came up to 1/2 candle and was put on 18 cells battery permanently ~~for~~ at 1.30 AM —
~~#~~ Page 105 + Page 115

No 3 Came up to 1½ gas jet leading wire melted on account of conduction acrs mica (?) see page 115


20
60

was put on machine with 3rd speed
6 cells in field — It had an
enormous resistance

No 10 Considerable resistance —
equals 1 gas jet —
had a small arc in —

No 9 On from 1.30 AM till 3 pm
1½ hour and was then
raised to 3 gas jets for
1 hour then cracked glass
busted

No 11 A great many were made
and boiled in tar before
carbonizing but all so done
broke in carbonizing —

Electric light. Oct 27/1899 117

Carbonization

I carbonized the following substances in closed tube at red heat:-

1 Vulcanized fibre
2 Celluloid
3 Rosewood shavings
4 Cocoa nut husk and shell
5 Drawing paper No 1
6 Architects drawing paper
7 Drawing paper Sample 30-3
8 " " " 3
9 Spruce shavings
10 Hickory "
11 Baywood "
12 Cedar (red) "
13 Rosewood
14 Fish line
15 Maple shavings
16 Tissue paper string
17 Cotton Lampwick
18 Plank.
19 Cork
20 Bagging flax

N.S.C
Med
29-98

Lamps Oct 28th 1879

12 ~~Eight thickness~~ of 200° thread twisted and lampblacked a little—length of incandescent surface 3·5 inch ——

~~Stick~~ !!! Busted by Bohm

Made new carbonizing chamber

13 8 thicknesses of 200° thread twisted + blackened a little length of surface 3·40 inch

Busted by Bohm

14 4 thicknesses of 200° thread twisted together + blackened with Lampblack + tar

Broken in Carbonizing

15 3 thicknesses of 200° thread plaited together and rubbed with Lampblack Mixture

16 6 thicknesses of 200° thread twisted together (Brought up to yellow & called off)

17 ditto (Bursted (after getting 3 gas gets out of it) about ⅛ from one end ~~[illegible]~~)

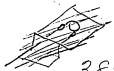
18 ditto

19 ditto

No 19. Had a variable resistance starting at 48 ohms and running down to

Resistance 48 — red heat

" 40·5 . white



" 38·9 mean

" 35·0

No 20 3 inch long made of 5 strands of Clark's 300s 3 cord — This when carbonized went out of shape considerable but was intact

21 Made of 300# 3 cord
3 inch long — good after
Carbonizing

22 Burnt in Carbonizing
300# 3 cord

23. 300# 3 cord
Burnt in Carbonizing

24 300# 3 cord 3in long
Carbonized in new chamber

25 300# 3 cord 3in long
Carbonized in new Chamber

26- 300s 3 cord 3 in long.
Carbonized in new chamber
came out bad shape

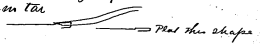
---

27. 24s — 6 cord — 3 in long
no tar or lampblack on
at all — Bare thread tied
to platina supports with
200-6 cord not tarred
Joint of thread Resistance 150.000 Ohms

---

28 24 — 6 cord — 3 in long
a little tar ~~on~~ lampblack
on the joints
joint of thread 157 000 Ohms

29 Card such as we mount minerals on — 3in when put in — shrunk very much in carbonizing — 250 ohms cold joint:- no tar



30

Card :- 3 in long
shrunk very much in Cn
250 ohms cold

No tar on joint

joint so:

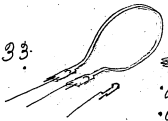
31

24s 6 cord made into lock ~~stitch~~ stitch ~~fastener~~ fastener to platina by winding 200 6 cord round platina and thread

32

Made from card
1/32 wide – 3 inch long
Butter in Cutting

Dmt
Mar 15/13.

33. 

Made from card
~~1/32 wide~~
·043 wide
·010 thick
3·312 long –
with wide ends and the platina doubled and put through

34

Three pronged round clamp

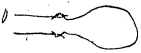
3

25
3
75

·3
75

25 | 1·00
·04

·050
2·2
0
0
0

40 

Made for test
but too great resistance
40.000 ohms

3 m card
1/16 wide

3rd mark 23/23

~~41~~ 3 m cardboard
41 . 1/16 wide
connection made as :—

made for Show

Nov 11th 1879

Made chamber for carbonizing
and cut out pieces 40:
and carbonized
a number in be-
tween cards ~~they~~
came out excellent

slightly wavy but straight and flat on the ends

Nov. 12th 1879

In order to bring the cards out of carbonizing chamber perfectly straight we found the only way was to put sheets of tissue paper in between the loops (instead of cards as we had been) using and after to alternate layers of loops and tissue sheets to put a small piece of carbon to act as a light weight on top.

then close the whole up in a chamber and heat very slowly taking care not to get too great on it until after all the volatile matter has gone off which will be known after ~~all~~ it has given over smoking—then put in furnace and bring to a yellow heat

Nov 12th 1849 Chas Batchelor
J. Ponini

Nov 17th 1849 141

Lamp.

42 flat card
Carbonized well
and kept perfectly flat

We find that the brass clamp
are bad from the fact that
the heat takes the temper
out of the brass and tends
to straighten out the prongs
eventually letting the loop drop out
~~of the~~ from between them.

We have made some of steel
wire so which have much more
spring

Nov 17th 1849 Chas Batchelor
C. Batchelor

In order to prevent the bad effect of the prongs opening, owing to the heat tending to straighten them

we make it so:—

Now if the heat tends to straighten the prongs they will press tighter on the loop.

Nov 14th 1849 Chas Batchelor

Lamp 43 Made of card out from new model and set in new clamp steel same as above

Nov 14th 1849

Chas Batchelor

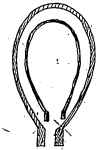
Witness

Lamp 44

Made from new model
with straight steel clamps

Resistance after bringing up
in vacuum

The new model that we cut the



papers from has a
surface before carbone-
zation of
thickness of 43
making true radiating
surface of

After carbonization it has these
dimension length 3·025
width ·032
thickness ·005

reduced

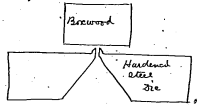
Cutter

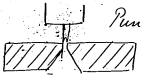
Cutacu.

round 3 a round 3

Stamp Card Cutter

We must cut these loops out by punches and the following devices might do:—





Punch and die steels cut Punch stripped out its whole length

Nov 1st 1849

Chas Batchelor

Nov 18th 1919

Lamps
45 } Both alike and same as
46 } 43

Nov 25th 1919

~~Resistance~~
Lamps
47 same as 43 Book 85 page 210
48 same as 43 " " " "
49 " " 43 ~~Book~~ 85
50 " " 43
51 same size as 43 but made from old automatic bibulous paper .0045 thick

2 Same as 43

53, 54 Made as models for patent office

55 Same as 43

56, 57, 58 Same as 43

59, 60, 61, 62, 63, 64 Same as 43

~~Nov 18~~ Nov 23rd 1899 Chas Baschlin
H Shriver

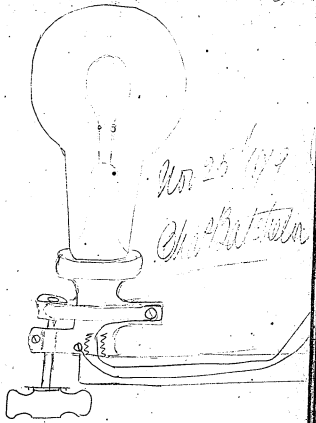
65 Made out of Bibulous chemically pure paper .0045 thick

lamps

I notice that when I make one from bibulous paper as in case of 51 and 65 they shrink much more in carbonizing than those made from cardboard like 43

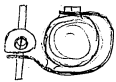
66
67
68
69
70
same as 43.

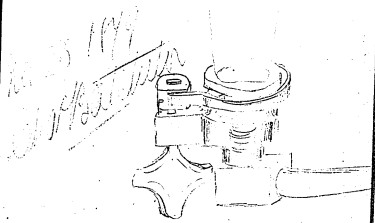
All that we have made like 43 are cut cross ways out of the card



Nov 25 1924

Unbreakable





168

1200
50
6000

100,

16.30

Portland

60000

Portland

365
60
21,900
8

150
200
30000
80

1200
15
6000
18000

2

1200
30
46000,
30,000
30000
12000
11800

125000
16000
141,000

14

40
5
200.

365
200
670.00

169

75,

30

14000
28000.
36500
78,500,
16.30.

60
30
1800

50,

25
8000
200,000.

25

30 00
16 30
13.70.

365
200
73,000.

365
13
1095
365
4.743
25-5-5-0
3000,50.

365
70
25,550.

10
18
6
40
5
10

12 , 36

1

Portland Portland

7

365
100
36500.

November 25th 1879

Put 3 ~~Horseshoes~~ Gelucon plaster pans first a layer of pp then a horseshoe then pp ~~&~~ so on smoothing down before laying paper on. then Carbon weight on top = -

Replace Plaster of Paris by - Chalk - magnesia, Caustic Lime, Magnesia, - by Plumbago - Silica, Pumice stone.

16.2

Nov 25 1919 163

71 Piano wire clamp with large flat platinas on the card cut lengthways so that grain (as it were) lays that way. Carbonized with white tissue paper (not oiled)

72 ditto — — — —

73 ditto — — — — —

74 Same as 43

75 Piano wire clamp — Loop cut from higher calibered paper .0045 thick found in Nimcy's table

164

Apr. 26 - 1879 [illegible]

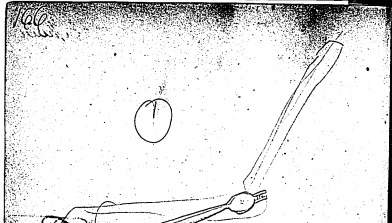
Tried carbonizing with Charcoal but 3 hours alone in the crucible and brought it up to a red heat found that the charcoal burned out rather [illegible] than the charcoal adhered to the paper

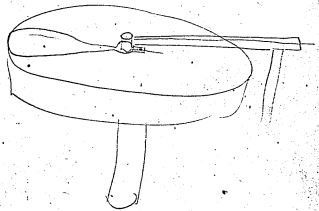
[illegible]

Next tried Plaster Paris found it would not do, for the sulphuric acid combines with the iron leaving sulphide of iron spoiling the paper

Tried carbonizing with chalk but the heat to which it was subjected formed the chalk into a solid mass spoiling the paper

Made a roll of it and used the oxide of Manganese method of charred carbon now not notes a





Dynamos	30.000.
Engine	36 000
Boiler	24 000
Extras	12 000
Contro.	16 000
	118 000

30
1200
30
36000

150
50
7500

12050
36000
150
80
12000

150
200
30,000

34705

117
365
585
702
351
32,705

3000

125.000.

10

Emp	9
Foreman	18
Stokers	10
Fitters	10
Coal	28
Oil	5
Water	2
Water	5.
Fitts.	10
Rent	20

Coal.

3
3 365
200
73000

1

60000

365
20
73000

125.000.
365
120

365
120
73000
365
73000

Nov 27th 1919
Chas Baltzell

Lamps.

176 Same as 43

77 } Same as 71
78 }

79 } Made from Cranes patent
80 } Merit No 56

81 } Made from Cranes patent
82 }
83 } merit No 44

Dec
Mch
23/12

38000 Expenses
10 000 Depreciation
48.000.

Tests of papers and Cardboards for ash

Bristol Board A ~~very small~~ fair

" " B loaded badly

" " C fair not loaded much

D + B card 8-76-7 splits in three in frame

" " " " " 5 very heavily loaded

" " 8-76 X 21 splits in ~~three~~ 4 pretty well loaded

5-79- 50 splits in two not loaded

5\79- 33 splits in three heavily loaded (Alq)

5\79 — 43 ~~very lightly~~ not loaded

6\77- 43B not loaded at all

9\76- 47 not loaded at all

over

P Ely B. 8-78-
very heavily loaded

P Ely B. 8-78 — 37.
heavily loaded

P Ely B. 9-76 — 36
fearfully heavily loaded

P Ely B. 5-77 — 29.
Pure —

P Ely B. 8-78 — 34
considerably loaded

P Ely B. 5-79 — 33
Nearly loaded Mg.

P. Alg. B. 8-78 — 30
heavily loaded with Mg

P. Alg. B. 8-79 — 29
heavily loaded with (Mg)

P. Alg. B. 5-77 — 28 —
not loaded

P. Alg. B. 6-77 — 29 #
very very pure

P. Alg. B 8-78 = 28 —
not loaded

P. Alg. B 8-78 — 27
not loaded but eighty

P & B. 8-18-25—
exceedingly heavily loaded

P & B. 8-18-20
heavily loaded

Lindermeyer Sample
very heavily loaded

Francis & Isabell sample
rough paper
only loaded slightly

Goodman & Schank
Bottle Green Binder
heavily loaded

G & S. Satin Enamel
all emus & pieces
heavily loaded

Q Ans S. Artists Black Bristol
not loaded

Q Ans S. Brown Bristol
loaded heavily

Q Ans S. Neat Bristol 4 ply
loaded heavily

Q Ans S. Navy Blue Bristol
Brokers and falls all to pieces
leaves blue pigment

Q Ans S. Neat Bristol 3 ply
heavily loaded

Q Ans S. Neat Bristol 2 ply
heavily loaded

G Ms S. Victoria Tinted
Badly - loaded

G Ms S. Lenox Bristol 4 ply
3 ply
2 ply
loaded

G Ms S. Translucent Bristol
Badly loaded

G Ms S. Cloth lined Blank
loaded only slightly

G Ms S. Lithographers 2 Ply
Bristol Blank
loaded.

G Ms S. Thin Satin White

Nov. 27-1879- 181

Tried carbonizing with caustic Magnesia formed into a solid mass and broke the jaws all up — — —

T Edison

Also tried carbonizing with powdered carbon - failed N. G. -

T Edison

Nov. 28th 1879

Carbonized with mica instead of paper - the lines were came out very smooth but broken - put two carbon plates

T Edison

Tried mica plates without any carbon and found that they came out flat but out of shape

T Edison

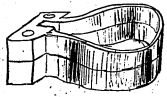
Nov 28th 1883

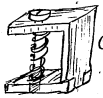
Lamps

84
85
86
87
88

Made from card same as 71

Made a new steel cutting form for loops with 4 clamps to hold it together





This cuts them much more even

Chas Batchelor
F. Poulier
J. Seymour

Nov 28th 1879

Lamps.

89 } Made from 0010 Bristol board
90 } and cut out with the new
91 } 'former'

92
93 } same as above
94

Nov 30th 1879 –

Made 15 lamps same as above
No. 95 – 109 inc –

Dec 1st 1879

Made 15 lamp same as above
110 – 124 inc.

186

Fault in Lamps Dec 4 1887

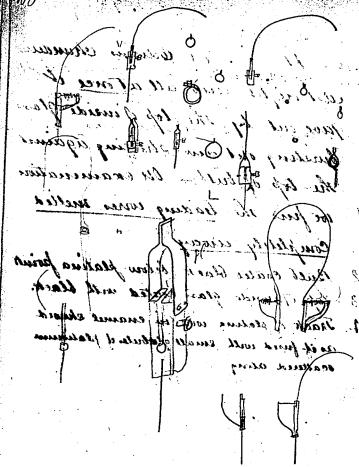
Lamp 118 was on Edison chandelier last night and all at once it gave out by the top of inside glass bursting out and striking against the top of bulb— On examination

1 we find the leading wires melted completely away

2 Bulb coated black below platina point

3 Top of inside glass coated with black.

4 Track of platina wire in enamel showed as if fused with small globules of platinum scattered along



Fault in Lamps

Lamp No 101 after giving excellent light during exhibition last night delayed out by reason of the loop falling off the clamps — loop keeping intact —

On examination I found

1 Black deposit thick below platina points and slightly all over the globe

2

"

Dec 4 1879 191

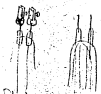
General faults.

1 We notice that some of bulbs are perfectly clear after bringing up and using whilst others are covered with black – this may be from the fact that some may be better carbonized than others and those not carbonized are brought to higher heat in vacuo & give out more stuff that coats the glass

Chas Batchelor

Dec 4th 1879

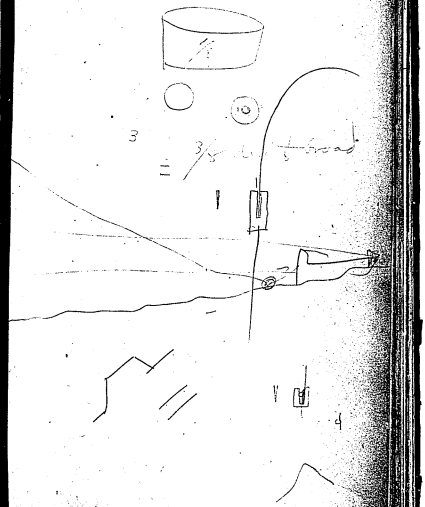
Made 4 lamps with new platina clamps so: also made glasses (sealed on platina wires) stick out of glass so:—



These were great improvement and are numbered

125 – 126 – 127 – 128

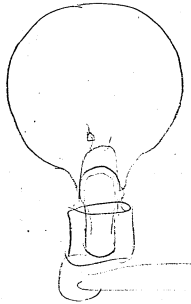
Chas Batchelor

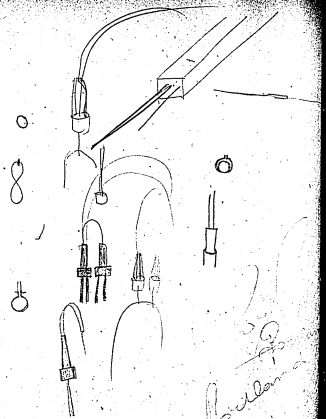


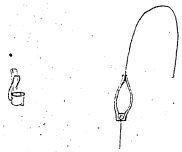
Test of E Light Dec 5th 1879

On Dec 3 we made a test at Edison's house at which Mr Fabri and party saw it - We lit 2 three light chandeliers 1 two light ditto and ran the sewing machine and hand lamp all went off perfectly with the exception that I put in one lamp and the wires projected too far and made an arc on brass underneath this did not hurt the lamp —

Chas Batchelor







Dec. 5th 1899

Put a horseshoe in a cylinder and
heat it over the gas flame for 1/2
hour with a weight of (~~[illegible]~~) 97.25 gm
had 3 jets of gas and put it over on 1825
and put it in the fire at 11.15 and
let it remain for 28 minutes until
it came near melting – came
out all right – but changed
from 1 to 3 –

Put 3 horseshoes in same as before
and they came out with the top
one the largest and the bottom
one the smallest. The weight
being about gas 98.3 –
did not seem to be altered by
the reduced weight

Lamps. Dec 5th 1879

Took one regular loop and marked the inside edge of it so:—

This I made a standard to pick others out from the whole — After picking them out to size I took them carefully over under the microscope and throw away any that have flaws

We now use of course new glasses (inside) and platina clamps

Made 4 lamps No: 129 - 130 - 131 - 132.

Made 4 more No: 133 - 134 135 136

All these we found no good as in blowing the inside glass it is left too thick so that it cracks with heat —

Dec 6th 1879

Lamps.

We now had Bochm blow the glass inside thinner

We made 4 this way

Nos 137 - 138 - 139 - 140 -

Platina clamp

Chas Batchelor

Dec 8th 1879

Made 3 lamps with Carbons carbonized with weight of 126 grains Troy of carbon

No. 141 142. 143

Chas Batchelor

Resis 141 — 295 ohms
" 142 — 300 —
143 —

Dec 8th 1899

Made 1 lamps with paper carbonized (½ hour in muffle) with carbon weight of 400 grains

No. 146

Chas Batchelor

Made 2 lamps with paper carbonized with weight of 250 grains

No. 144 and 145

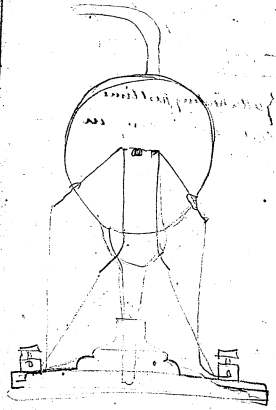
Dec 8th 1899

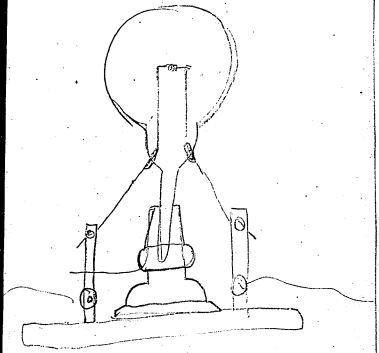
Chas Batchelor

Decl 1149

Resistance of Lamps

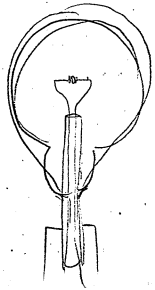
		after	
141	—	295	— 154 after heating
142	—	300	— 150
143	—	152	after heating first time
~~144~~		~~152~~	
145	—	Busted in putting in —	
146		752	after heating
147			
148			
149			
150			
151			
152			
153			
154			





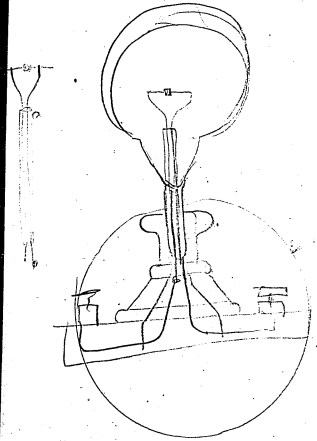
79
2.00
158.00

79
4.00
316.00



100

79.



Lamps. Dec 8th 1899

147 Same as 141

Resistance at first 300

" after heating

" when sealed off + cold 145

---

148 Same as 141

Resistance at first 290

" after heating

" when sealed off (cold) } tested at Clamp

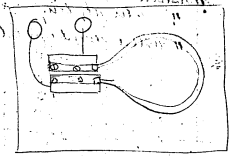
---

149 Same as 141

Resistance at first 340

" after heating

Cold " when sealed off 150



Lamp.	Same as	Resistance	Meas. after Sealing
150	141	245	114
151	141	275	160
152	141	295	Broke on pump.
153	141	300	132
154	141	310	122
155	141	300	126
156	141	300	154
157	141	240	199
158	141	320	139
159	141	275	153
160	141	415	145
161	141	415	147
162	141	390	
163	141	390	
164	141	245 270	132
165	141	240 255	150
166	141	250 265	134
167	141	252 250	136
168	141	250 247	144
169	141	250 265	Busted on pump
170	141	250 265	154
171	141	250 250	142

Dec 10th 1849 223

Lamp	Same as	Resistance at first	Resistance after heating	Remarks
		235	135	
172	—			
173	—	Busted	by Bohm	
174	141	260	147	
175	141	240	135	
176	— 141 250	285	167	
177	— 141 do	245	155	
178	— 141 do			
179	— 141 do	250	195	
180	— 141 do	250	150	
181	— 141 do	245	152	
182	— 141 do	255	160	
183	— 141	—	—	Busted by Bohm
184	— 141	245	145	
185	— 141	240	132	
186	— 141	275	155	
187	— 141	235	128	
188	— 141	240	142	
189	— "	270	149	
190	— "	Broken at clamps		
191	— "	250	135	
192	"	Broken at clamps		
193	— 141	230	134	
194	— 141	—	121	
195	— 141	Busted somehow	—	
196	— 141	265		
197	— "	250		
198	— "	240		
199	— "	240		
200	— "	230		

Dec 18th 1879

Carbonization

Chas Batchelor

Used plumbago in the mould round the edges but they came out 390 ohms resistance ought to be 250

Put three in iron mould and carbonized without previous heating but they came out 490 ohms

I think that the tarry matter must not be driven out quick but left in if possible to lock the particles together in a hard shiny mass. therefore the first heating ought to be very slowly.

226

100 volt
10 ohms

$C = \frac{E}{R} = \frac{100}{10} = 10$ C

$\frac{200}{20} = 10$

100
100
10000
44
10 | 44000
44000 for 4

20
40
44
4 | 176000
88000

Dec 15th 1879

Carbonization

Tried a mould of two plates of carbon from Condit and Hanson battery – First lot came out high resistance and crumpley there was a great lot of brown stuff came from the Carbon probably sugar put in in moulding

Second and third lots came out over 1200 ohms resistance

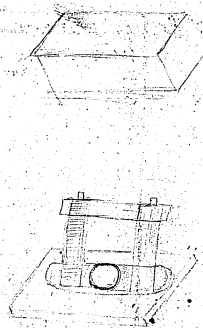
Chas Batchelor

Dec 15th 1892 — 9

Make some lamps circular in shape so:—

Inside length 2 inches
make them such a width that they will be 100 ohms resistance —
~~leave the circle complete and let current break out piece between clamps~~ break out the piece between clamps

Chas Kathello



Temp.	Same as	Resistance in Ohms	Resistance setting	Sec.	Remarks
201	141	255		15	
202	"	225		15	Water in pump, after being heated up 5 hours
3	"	225		15	
4	"	275		11	
5	"	260		11	
6	"	240		11	
7	"	240		11	
8	"	370		11	
9	"	270		11	
210	"			11	
11	"			11	
12	"			11	
13	"			11	
14	"			11	
15	"			11	
16	"			16	
17	"			"	
18	"			"	
19	"			"	
220	"			"	
21	"			"	
22	"			"	
23	"			"	
24	"			"	
25	"			"	
26	"			"	
27	"			"	
28	"			"	
29					
230					

36500
35000
5-1401

150.000.

10
18
35
5
10
1

365
90
50.

365
100
36,500

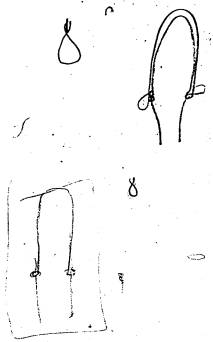
Dec 15th 1879 83

Carbonization

In order to get at the bottom of the fact that all do not carbonize alike in same chamber at same time we made following test:—

Cast iron chamber —
3 loops in each —
Tissue sheets between each and between loop and iron and a plate of carbon of 126 grains as weight on top

OEL



Resistance

	top	middle	bottom
0			
1	207	234	217
2	240	255	210
3	212	212 -	211
4			

No 3 had 2 sheets of paper between the iron and also between carbon this seems to make it more even —

Carbonization :—

Points from which to draw conclusions —

1 Middle one is always highest resistance

2 All lengths of times in Carb. give good ones

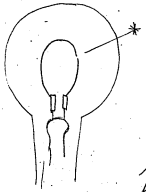
3 All heats gives us good ones

4

Lamps

Dec 15 1899 — 39

Lamps Nos 200 and 202
had been burning about 4 hours
of Dec 16 and 1 hour on Dec 17
when both busted as in sketch



Upton suggests
that it may be
in the focus of the
curve of glass
It does not seem to
be exactly in the
focus of the curve of
the other side of loop.
They were burning at about 5 or
6 gas jets

A. W. Ketchum

Carbonization Dec 17th 1919

Put a carbonizing mould with loops in on gas flame 25 min — Opened it and it measured 10000 ohms

Brought it up bright red in Muffle for 10 min — Took it out and it measured 600 ohms

Put it in again for 1 hour at same heat and took it out again 270 ohms —

Put it in for 1 more hour and after bringing it out it measured

New Lamp loop (see page 229)

Make punch punch out

2·81" circumference of inside

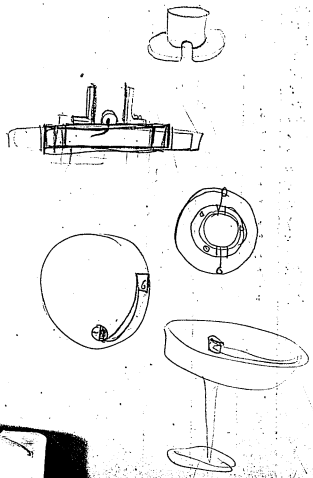
·0288 width of loop side.

This will centrize down to

circle of 2·25 inside circum or ·71 diameter

which will be ~~[illegible]~~ — same

resistance as present loops



Ty	Tamp	Same as	Reis. at Yard	Mus when Sealed	Remarks
4	231	141			
	232	"			
	233	"			
	234	"			
	235	"			
	236	"			
	7	"			
	8	"			
	9	"			
	240	"			
	241	"			
	242	"			
	3	"			
	4	"			
	5	"			
	6	"			
	7	"			
	8	"			
	9	"			
	250	"			
	51	"			
	52	"			
	53	"			
	4	"			
	5	"			
	6	"			
	7	"			
	8	"			
	9	"			
	260	"			

Dec 29th 1897

Lamp. 204 Broken in inside glass — glass exceedingly thin — wires melted

Lamp. 260 Carbon broken — 1/4 inch above regular place

*245 wires melted — glass thin —

247 Carbon broken

84
8
672

100

300

100,000

1200

40
60
00

400

5 | 1,000,000

100

200,000 2 1.

750000

40
50
2000

75

2.5 40.

12 25 80

2½ 25 160

320

25. 640

2500

2½ 63. 7½
60 8
5
12. 60

10

5-gas.

400
50
100
150
700

5- 25-
3-
125.
120
245-

245-
31
245-
735-
7.5-9 5-

94.

100

15-
8
120

3.75-

15/25-

12
31
12
36
372

23.
2
46
11 50
571.50

21.
4
84.

5.

25.

125.
120
245

15.
8
120.

245
31
245
735
7590
3
2278 5

Faults See

250 Glass busted – wires melted out –

201 Busted in carbon ¼ above regular place

259 Carbon busted in regular place

252 – Carbon busted in regular place

6 60,

10

50,

100 | 440000 (4400
400
400
400
400
000

40

40000 4400
10
44000

400 | 440000 (1100
400
400
400

2200,

1100
20
22000

1 400
2 200
4 100

~~245 Glass busted Wires melted~~

227 same

150 Carbon broke at ¼ above crychised. badly

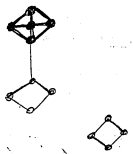
156 Glass broke
141 " "

184 Carbon busted right in top

220 Carbon ~~busted~~ broke on pump.

199 Bust in Glass

223 Bust in Clamp



100. Société du T

100. Société Generale

Germain 50. Du Tel

Germaine

50000000000

1/50.

1/50.

Jan 2 1900

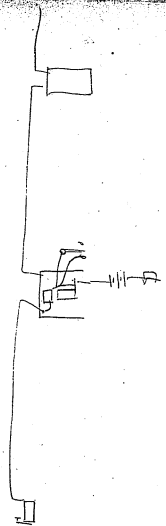
No 167 I saw burst, and inside glass broke and inflating clamps falling together crossed and burnt out the 'rod' of chandelier – Burnt 8 hours

217 Burnt 4 days

Chandelier over Griffs desk

Broke 1/4 inch above regular place probably had vacuum

Edison brought the true



Lower for 12 week
Tapers are carbon. The carbon that my
4 or 5 days
If bread full of water for hour can back
to more than original lowers
showing that you can take chalk
has been wet some time

All with cards & allow to stand 1 hour
that of they have uneven talk
Can even clap if bread quite dry
just scarcely give water & chalk
then in fifty thousand
take time then only cut all
without covering body of sound
for 1 minute

Very man made an improvement
mind either spirit down result
90 telephone lower pens all set
wrong water — Very man got
good wise

25 $E = 100$ $R = 4$

$C = R$ —

~~$\frac{E}{C}$ $E \times C = R = 100 \times 25$~~

$\frac{E}{R} = C = \frac{100}{4} = 25$

$C \times R = E = 25 \times 4 = 100$

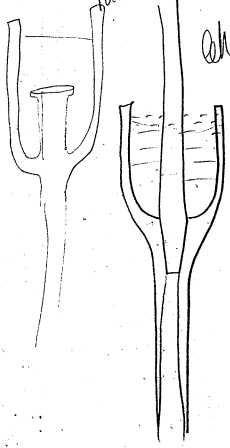
$\frac{E}{C} = R = \frac{100}{25} = 4$

If chalks are turned up and put
in telp. they will take equally
well with their own weight of mould
to truth will have than
a few minutes of course that
will cost tool to long but in case
emergency is good

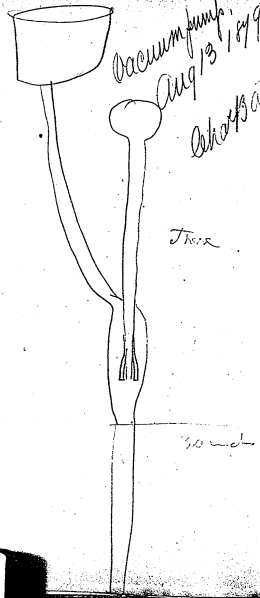
Aug 12 1919.

Vacuum pump

Chas Sartelle



1 13.5



Vacuum pump
Aug 13, 1919
Charles Atchelor

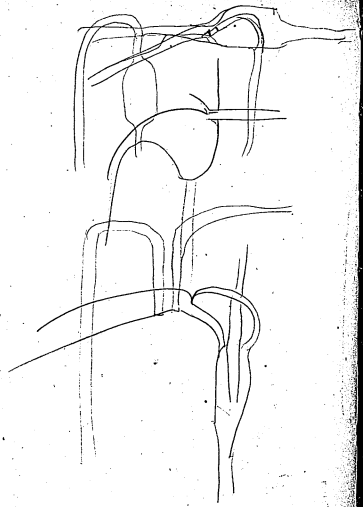
Now is the time for all good men
Made glorious summer by this son of
York and
There was a little
4000 = 160
1200
3000 - 150
1460

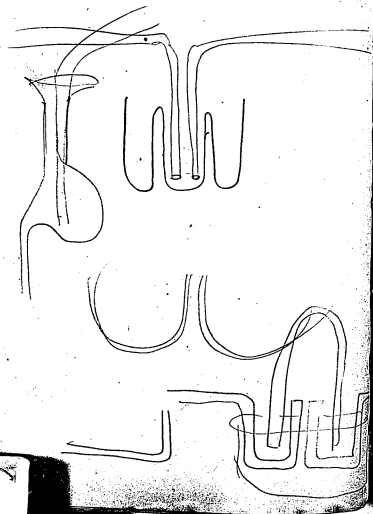
1234567890

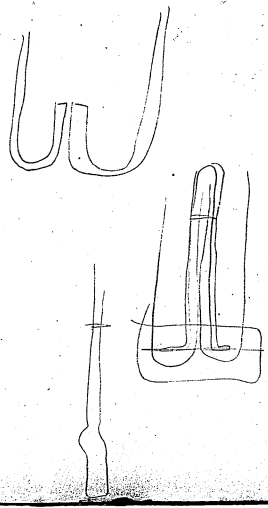
1234567888890

14 There was a little girl

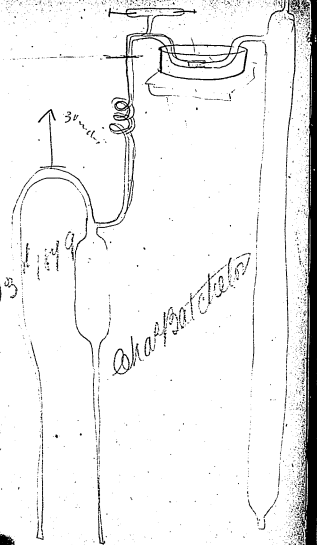
1760







Pump

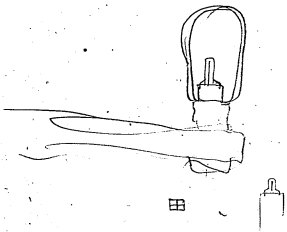


3 16 9

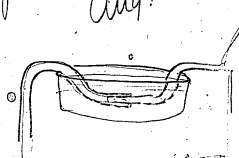
3. 16.

5. 1.

18. *



Vacuum pump Aug. 13 1849



84.

18 Charpatchetes

9.40 lamp

100.

84.4 84 of 20 per hp.

794.

8. .10

84.4. 1 100 000 ft — 180.

9 4

75.8.6 336.2 36. 75-000 lib 100

7.9.4. 8 20. 20.

84 9 .11.

4

336

36

25.7

75.

75

3 75

5 25

5 6 25

5 candles each

18

1/16

2 hp.

18. of 20 cp each.

9 of 20 cp each per hp.

7.73 2 9 105

173) 180 (1.04

17 700

1.5-6 2.5

180

56

1080

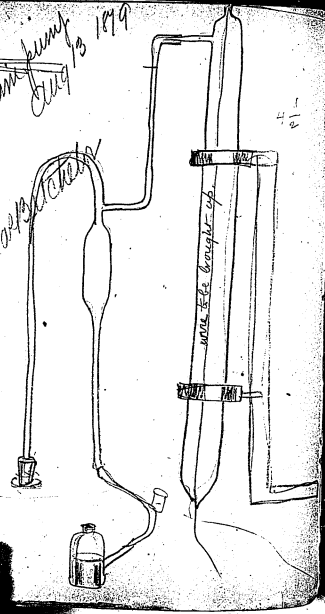
900

10080

4771

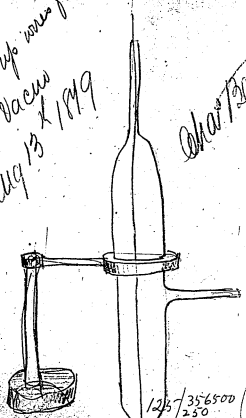
2385

Vacuum pump
Aug 13 1899



Secretary
Bringing up wire for
lamps in vacuo
Aug 13 1919

Wheatstone Bridge



125 / 356500 (2852
250
1000
1000
6500
6250
2500
2500

125 / 356500 (3100
375
1750
1750
0

.031
24
124
124
1.488

4 ft of .010 wire has surface 1.488

practically 1½ inch

100
100
10000

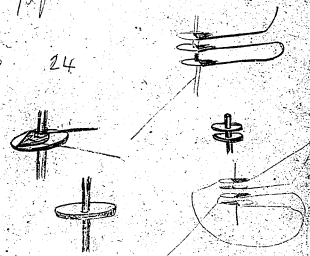
44
100 / 440000 (44
400
400
40

100. \ 3564
1.15 3100
1.25 2852

90
81
324
100 / 356
300
56
50
6

EDISON'S
TELEPHONE
24

Electric light regulator

July 31 1879
Chas. Batchelor

3 24